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REGION X

ON-SCENE COORDINATOR REPORT

POLYCHLORINATED BIPHENYL SPILL  
(PCB)

DUWAMISH WATERWAY

SEATTLE, WASHINGTON

SEPTEMBER 13 - OCTOBER 31, 1974

USEPA SF



1212939

#### ON-SCENE COORDINATOR (OSC) RECOMMENDATIONS

1. In order to effectively remove remaining PCB material within the immediate area of the spill incident a major dredging effort should be immediately programmed by the Department of Defense (DOD) through the Corps of Engineers (C/E) maintenance program.

2. DOD should immediately pursue seeking a satisfactory land disposal site for the 215 barrels of contaminated sludge now stored in the Air Force warehouse. This should be coordinated with State and other Federal agencies to insure safe disposal of the material.

3. EPA, Environmental Water Quality Research Laboratory, Edison, New Jersey, immediately undertake steps to insure rapid activation of the Rexnord Treatment Unit. This should not only include routine maintenance of the unit but also advance clearance of highway permits to assure immediate nation-wide dispatching of the vehicle.

## ON-SCENE COORDINATOR (OSC) CONCLUSIONS

### Regional Response Team

1. Pending Hazardous Material Regulations as published in CFR 40 Part 116 make it imperative all field investigators be continually alert and recognize hazardous material spills.

2. The EPA Rexnord Treatment Unit was not prepared to respond to emergency spill incidents nation-wide nor is it maintained in a readiness condition.

3. The Regional Response Team (RRT) functioned very effectively in bringing together the resources and personnel required to carry out the removal operation.

4. There is an immediate need to establish local DOD responsibility able to commit DOD resources to cleanup spills where agency responsibility cannot be directly determined.

5. Total contract cost for the removal operation (excluding barrel disposal and removal of the remaining contaminated sludge) was approximately \$148,183. The volume of PCB removed was estimated to be in the range of 70-90 gallons.

PCB SPILL, DUWAMISH WATERWAY  
SEATTLE, WA.

BACKGROUND

On September 13, 1974, an electrical transformer was dropped while being loaded upon commercial barge resulting in 265 gallons of polychlorinated biphenyl (PCB) being spilled into the Duwamish Waterway.

The transformer, destined for Alaska to be used in conjunction with the construction of an Air Force Radar Station, Shemya, Alaska, had been requisitioned by the C/E and crated by the U. S. Army at Tooele Army Depot, Tooele, Utah. After being stored in an Air Force GSA warehouse at Slip 1, Federal Region Center South, the transformer was being loaded on to an Alaska Puget United Transportation Company barge (APUTCO) which was under contract to the Navy Military Sea Transportation Service (MSTS).

The spill was reported on September 13 to Seattle COTP, USCG and handled as a minor oil spill. A Seattle oil cleanup contractor, Marine Oil Pickup Service (MOPS), contracted by APUTCO, responded and removed some 4 gallons of floating material. The initial spill report to USCG did not reveal the involvement of PCB in the incident. On September 16, 1974 a follow-up investigation by both the Washington State Department of Ecology (DOE) and USCG determined that the transformer coolant was PCB and not an oil spill. DOE requested EPA

assistance to locate and quantify the spill on the waterway. EPA also initiated investigations into alternatives for possible removal and disposal of the spilled material.

The Duwamish Waterway is an important navigational channel within the City of Seattle. The mouth of the Duwamish River is affected by tides of up to 13 feet and regularly flows at some 4 knots. At the spill site it is predominately mud/silt bottom, fresh water, approximately 45 ft. deep and 500 ft. wide.

#### ENVIRONMENTAL IMPACT

PCB's are synthetic chemicals prepared by catalytic chlorination of the biphenyl molecule. Theoretically, 210 different compounds are possible through this process but in actual practice only some 102 compounds have been formulated. All have properties similar to those of DDT - chemical and thermal stability, low water solubility, low vapor pressure, high dielectric constant and high lipid solubility.

A number of studies have demonstrated that detectable levels of PCB exist in most aquatic areas and in many species. Others have shown that concentrations increase from hundreds to thousands of times from prey to predator. Because PCB are toxic to most organisms at some level, the long-term exposure to sublethal concentrations may pose the most serious threat to the environment. Such consequences as slowed growth rates, lowered disease resistance, and

disruption of reproductive processes have been reported. Birds seem to be particularly sensitive to PCB's with increased susceptibility to viral infection, impaired egg production and lowered hatchability and survival of the young. Evidence indicates that mammals likewise have demonstrated reproductive failures, liver damage, lowered disease immunity, and failure to gain weight.

#### GENERAL

The 75 KVA transformer involved was made by Westinghouse and has an internal coolant liquid capacity of 283 total gallons. The PCB coolant according to the manufacturers specifications tag was Enerteen, which is composed of 70% PCB (Aroclor 1254) and the remaining 30% trichloralbenzene. However, laboratory examination disclosed the coolant had been changed to 100% PCB (Aroclor 1242) probably because it would perform better in the extreme climate of the Arctic.

The 6'x6'x6' transformer is a metal box (with internal coils) with "fins" protruding from one or more sides. At the top of the transformer case on each corner are metal loops or "ears" installed for hoisting the transformer. The interior of the transformer is filled with coolant. A major portion of the interior space is occupied by the internal transformer induction coils.

This transformer was apparently crated by the Army at the Utah depot for shipment to an Air Force dockside shipping unit (WPLO) at

Seattle, Washington. On receipt of the transformer in Seattle, Washington, the Air Force unit warehoused the equipment and then "manifested" the item for water shipment by barge to Alaska. The stevedore/carrier utilized for this purpose was an organization known as APUTCO, which is a joint venture of two companies that for a number of years has had a contract with the Air Force for water carriage to Alaska. The contract stipulates that it is the shippers responsibility to see that all cargo is "crated for water shipment". It also provides that if WPLO finds a particular item inadequately crated for water shipment, it has the legal power to have it recreated at Seattle dockside.

WPLO receipted for this particular transformer about August 1, 1974, and simply stored it in the dockside warehouse. According to APUTCO, this transformer was crated in a plywood crate and was bolted to "skids" on the crate bottom. APUTCO stated that on this particular transformer crate the skids were composed of pine 4"x4" lumber which had some knots in it. The remaining three crated transformers had larger 6"x6" skids. On the exterior of the crate (according to APUTCO) there appeared the directions "lift by base only" and the center of balance was designated. The upper corners of the crate were fully enclosed and were not cut off to expose the corner metal lifting "ears" on the metal transformer case. APUTCO claims that in previous instances of handling transformers for shipment the packing crates had the upper corners all cut off,

thereby exposing the metal ears on the top of the transformer cases which were utilized to hoist the transformers aboard the barge.

On September 13, 1974, APUTCO began loading the barge and attached its hoisting gear to the 4"x4" bottom skids on this particular transformer crate and started to lift the crate off the dock. When the crate had reached an elevation of approximately 2' off the dock, either one or both of the 4"x4" skids broke at a point where the skids were bolted to the packing crate and the transformer fell the 2' to the dock. The fall broke or bent some of the "fins" on the metal transformer case. This ruptured the integrity of the case, thereby permitting the PCB coolant to spill. It is unknown how long the leaking transformer remained on the dock. At some time after the initial breakage the transformer was moved back into the warehouse of WPLO where coolant continued to leak but it was contained there with sawdust-type material used as a dam.

On September 18 an EPA field team collected some 29 bottom samples in the vicinity of the accident. The analytical results indicated the material had remained in two general areas, one immediately adjacent to the dock where the spill occurred and the second further out in the Duwamish River (Figure 3). After reviewing data, on September 23 EPA representatives requested a meeting the following day with COTP Seattle and all DOD representatives involved in the incident.



On September 24, EPA requested DOD (represented by WPLO, Air Force and Seattle District C/E) or the shipper to assume responsibility for the incident and begin cleanup. Responsibility was refused and therefore EPA assumed On-Scene-Coordinator role for cleanup of the pollutant. Because the material spilled was not oil, Coast Guard funds were unavailable and had to be obtained through EPA Headquarters.

EPA divers were deployed on September 26 and observed pools of free PCB material on the bottom. They also expressed the opinion that a dredging program to remove the contaminated material could be successfully carried out. As a result of the positive information gathered, both by the divers and the sampling programs, EPA activated the inland waters RRT on October 1, 1974.

Several alternative actions were outlined to the RRT including those below:

1. Utilize hard hat divers pumping water and contaminated sludge into a Navy 100,000 gallon barge. This operation would require additional facilities to off-load the barge, treat the effluent and dispose of the sludge.

2. Utilize a 22" pipeline dredge to remove some 8,000,000 gallons of water and PCB contaminated mud onto Kellog Island. Kellog Island is immediately across the waterway from the site, owned by the Port of Seattle and presently used as a dredge spoil

disposal site by the C/E. This operation would require constructing several large ponds, moving some 30,000 yards of material. It would also be necessary to line the ponds for complete retention of all fluid. It was estimated a one day dredging operation would be required.

3. Utilize divers with small hand held dredges pumping water and spill material through pre-settling tanks and using EPA's Rex-nord Treatment Unit located in Edison, New Jersey.

Evaluation of three alternates resulted in the initial selection of the second approach. The first alternative was eliminated because of the lack of adequate barge holding capacity in the area together with the lack of subsequent sludge disposal site for the contaminated mud. Logistics problems associated with the third approach resulted in its initial rejection.

On October 2, after an on-site visit by a team of geologists from EPA, C/E and DOE, it was decided that the necessary holding ponds could not be economically constructed due to poor soil characteristics. The need to retain all effluent and sludge made it necessary to completely seal the ponds in order to prevent any seepage or runoff. It was estimated that 30 days or more would be required to construct the ponds and cost more than existing funds would allow. Logistic problems such as access to the island, construction, etc., were reviewed with military personnel from the

6th Army, Ft. Lewis and 13th Naval District and the use of the Island was eliminated.

During the investigation period discussions were also being held with the technical staff at Edison, N. J. National Environmental Research Center regarding use of the Rexnord Treatment Unit. The unit is a mobile water treatment plant utilizing primary settling, pressure and filters and activated carbon columns. It was hoped its use would reduce PCB in the dredge material sufficiently to permit immediate discharge back to the waterway. Because it was used successfully in a similar incident involving pesticides on the East Coast it was decided to utilize this system in the Duwamish Spill.

On October 3 the EPA Rexnord Treatment Unit was activated and on October 4 it departed Edison, New Jersey. In order to allow the truck/trailer unit (106,000 lbs) to travel through 11 States to Seattle it was necessary to obtain excess weight permits from the States in very short order. This proved to be quite an undertaking as several States have turnpike authorities and are not responsible directly to their respective State Highway authorities.

On October 9 the treatment unit arrived in Seattle. Numerous operation plans were tried during the ensuing setup operation and initial dredging which began on October 12. The State of Washington Department of Ecology conducted lengthy tests to determine the

most satisfactory settling rates of contaminated sludge. Tests were conducted using Alum, Feric Chloride, Lime and Nalco 634. As shown in Table 1 initial laboratory analysis of the effluent indicated satisfactory PCB removal using Nalco 634 at 20 parts per million and effluent was discharged back to the waterway on October 13. The dredging operation lasted some 20 days resulting in processing approximately 600,000 gallons of water and collecting 215 barrels of PCB contaminated mud. All contracts were negotiated in these plans, allowing for flexibility of operation and funding. The perimeter was physically cordoned off by a bubble screen of thirty two lengths, 50 ft. each, of 2" I.D. fire hose. The purpose of the bubble screen was twofold; (1) Satisfied the State Fisheries Department by allowing the fish to migrate around the spill area as opposed to entering and swimming through the recovery area. (2) Captivate and prevent PCB particles from spreading beyond the bubble screen area, e.g., either in pure particle form or microscopic particles that affix to mud or silt and then move with the tides and/or river current.

Initially four sludge suction CP-7 pumps with a rated capacity of 50 cfm each were used. The CP-7 pumps proved to be very inefficient because their performance level was at best only 30% of their rated capacity; solid to liquid ratio was between 8% and 11%, and time loss due to breakdowns occurred. Further, the pumps worked on a ball valve surge action creating two problems for the divers,

(1) The divers could not maintain positive control of the hose nozzels because of the variance in vacuum pressure created by the ball valve action. (2) The pumps surging action caused the silt and mud to become very cloudy, thus creating a visual observation problem for the divers.

Midway through the recovery program the CP-7 pumps were replaced with three Model M-8 Wilden sludge pumps. The M-8 pumps have a rated capacity of 80 cfm, and a solid to liquid recovery ratio of 12% to 20%. The M-8 pumps proved to be very effective, i.e., because they worked on a continuous feed action as opposed to the surge action of the CP-7 pumps. Also there was no pump breakdown time loss.

The river level depths was verified by conducting a fathometer reading over a cross section of the spill area. The depth checks were made aboard the U. S. Coast Guard Cutter that was in attendance throughout the operation. A maximum depth of 53 ft. was recorded.

The highest percentage level of PCB recovered was found in the initial spill area. However there was some evidence that the river current and tidal action had caused pockets of PCB to move about.

Periodic search missions were conducted by the divers beyond the established recovery perimeter; but found no evidence of PCB. Therefore it can be assumed that the toxic spill perimeter lines as established proved satisfactory.

Concentrations of PCB in the mud would indicate that approximately 70-90 gallons of the material was removed during the operation. While visual observations of the material on the bottom surface indicated most of the free PCB had been removed it was evident, based on bottom sampling, that concentrations of PCB remain high in the sediments within the spill impact area.

On October 31 the project was terminated on the recommendation of the OSC to the RRT. It was determined that the operation had changed from that of a hand held dredging program to one which would require a substantially larger effort ultimately requiring total removal of some 4,000 yards of bottom material from the Slip 1 area. A sampling program in progress during the latter part of the operation revealed substantial quantities of PCB remained tied up in the bottom sediments. Concentrations substantially higher than background were also noted out to mid-channel. It is estimated the contaminated area is about 200 x 500 ft.

Monitoring of the area will continue by the Region X EPA staff. It was also agreed that immediate disposal of the barreled sludge become the responsibility of DOD.

On Sunday, November 3, the Rexnord Treatment Unit departed for New Jersey and equipment was removed from the GSA Terminal.

To date, the cost of the removal project is approximately \$148,167. During the initial phase of the program \$125,000 was obtained through EPA emergency funding at Headquarters. These costs are tabulated on Table 2.

Follow-up sampling of the area during the week of November 4 indicate a migration of PCB contamination upstream as shown on Figure 4. This would indicate the contaminate is remaining in the area and ultimate removal should be programmed.

## SUMMARY OF EVENTS

Sept. 13      Reported by USCG as minor oil spill

"      16      DOE suspected PCB transformer spill. Notified EPA.

"      18      EPA conducts initial field sampling.

"      23      Joint meeting with DOE, USCG & EPA to review laboratory results of sampling program.

"      24      EPA assumes OSC after involved DOD agencies refused to activate cleanup.

"      26      EPA divers inspect spill area. EPA conducts second sampling program. EPA begins contractor negotiations.

"      30      Continue negotiations with contractor and finalize permission with Port of Seattle to use Kellog Island.

"      31      RRT meeting. Recommends geologist inspect island and determine feasibility of dredging operation.

Oct. 2      Geologist examines Kellog Island. Recommendation against use of island.

"      3      EPA activates Rexnord Treatment Unit in N.J. Sent telegrams to 11 Governors for Permit for excess weight.

"      4      Telephone confirmation on Permits with States. Truck leaves New Jersey.

"      7-9      Finalizing use of Pier with GSA and arranging contracts with divers.

"      9      Rexnord truck arrives Seattle.

"      10-12      RRT meeting. Initiate plant set-up and pre-Treatment operations.

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SUMMARY OF EVENTS  
(continued)

Oct. 10-12 Initial tests showed:

First Settling Pond	400 parts/billion
Second Settling Pond	400 parts/billion
Sand Filters	3.5 parts/billion
Final Effluent	75 parts/trillion

Average 1-2% Sludge Concentrations -

Low: 4 parts/thousand

High: 30 parts/thousand

Est. 125-150 samples water & sludge

Oct. 12 Diver dredging begins 1200.

" 12-31 2/3 diver operation. 215 barrels sludge removed.  
600,000 gallons pumped.

" 24 RRT meeting. Review progress.

" 31 RRT meeting. Dredging operation terminates. Recommend  
larger extensive dredging operation.

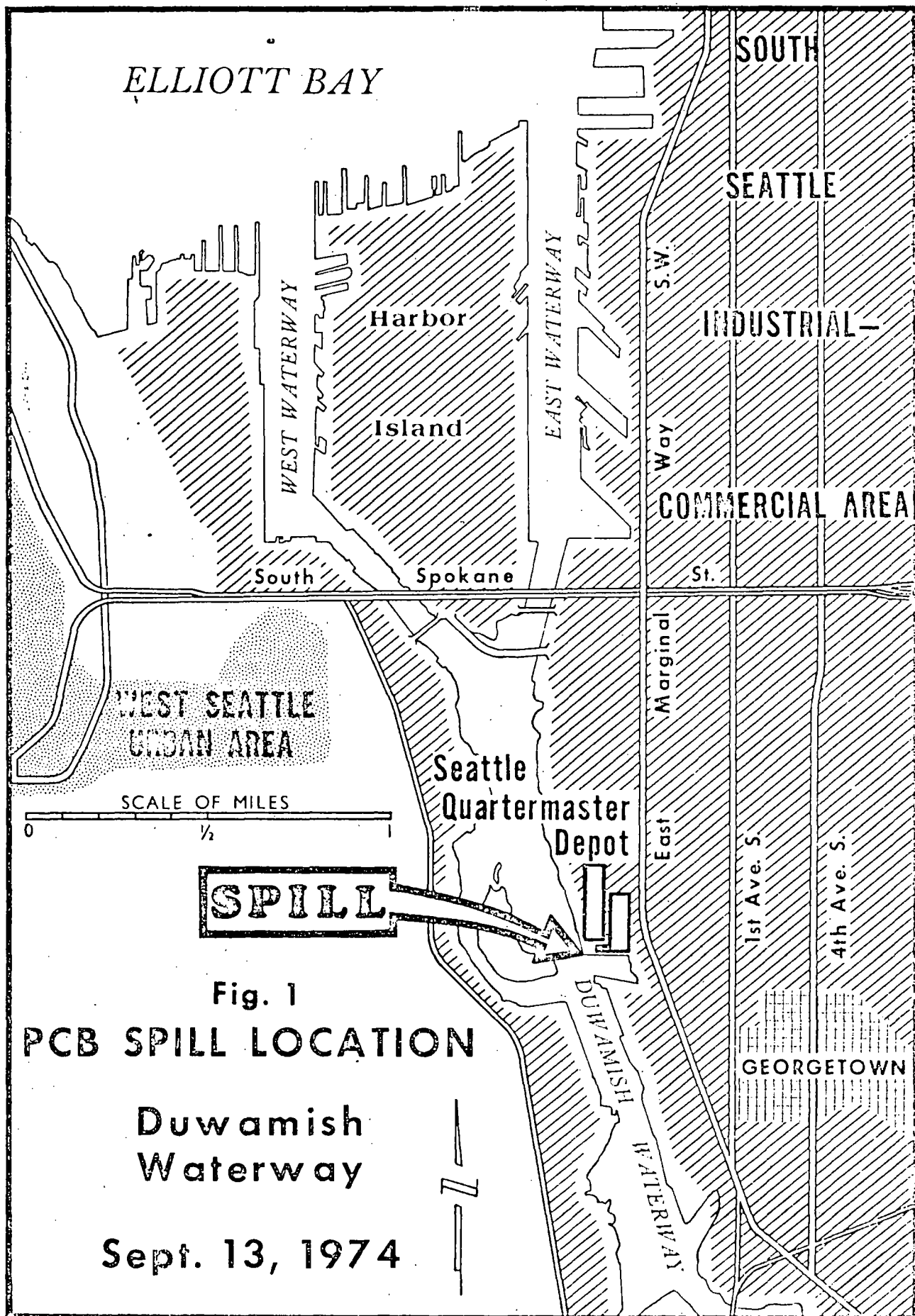


Fig. 1  
**PCB SPILL LOCATION**

Duwamish  
Waterway

Sept. 13, 1974

TABLE 2

PCB Spill Cost BreakdownManson & Hanger - New Jersey  
(Rexnord Treatment Unit)

Labor	\$ 7,000
Truck Cost	9,000
Subsistence and Travel	8,000
Maintenance	<u>8,000</u>
Subtotal:	\$32,000

Wesco (12000 pounds Carbon)	7,396
Envirex (Operational Personnel)	16,656
International Marine Explorations Divers	73,899
Miscellaneous (Pump rental, piping, etc.)	<u>5,054</u>
Subtotal:	\$103,055

Government Cost

EPA Region X Overtime	3,708
NERC Personnel Travel	2,031
EPA Headquarter Travel	1,916
Washington State - Department of Ecology	4,367
USCG Strike Force Travel	<u>1,156</u>
Subtotal:	\$13,178

Total Cost: \$148,183